PATENT SPECIFICATION

Application Date: July 18, 1938. No. 21324/38.

516,503

Complete Specification Left: Nov. 8, 1938.

Complete Specification Accepted: Jan. 3, 1940.

PROVISIONAL SPECIFICATION

An Improved Alloy for Fusion Welding and/or Soldering and Method of making such Alloy

I, HARRY THOMAS PAGE GEE, of 51 and 52, Chancery Lane, London, W.C.2, a British Subject, do hereby declare the nature of this invention (as communicated to me by Dorothea Surrey Lewis, of 242, Kooyong Road, Toorak, and Thomas Shead, of 105, Elgin Street, Carlton, both in the State of Victoria, Commonwealth of Australia, British Subjects) to be as follows:—

This invention relates to an improved fusion welding alloy which is capable of being employed at a relatively low temperature and is suitable for jointing and repairing aluminium and aluminium alloys, die cast metal and other metals requiring a fusion welding alloy stronger than common solder.

The primary object of the present invention is to provide an improved fusion welding alloy as above indicated which is capable of being applied at a relatively low temperature, whilst the melting point of the alloy materially increases after it has once been heated and employed in a welding or like operation. Other advantages of the invention are that the improved alloy includes a constituent which increases its strength and hardness in relation to known fusion welding alloys whilst another important advantage resides in the fact that not any flux is required for applying the improved alloy to aluminium, aluminium alloys or die cast metal.

Another object of the invention is to provide a simple and inexpensive process of manufacturing the improved alloy.

According to the present invention the improved fusion welding alloy consists of tin, zinc, and antimony. Electrolytic zinc is preferably employed and according to one practical example the alloy comprises the above constituents in the following approximate proportions:—

Tin	- -	16 ozs.
Zinc	- -	7 ozs.
Antimony	-	$1\frac{1}{2}$ ozs.

The range of proportions of the above ingredients may be varied within certain limits if desired. For instance, the proportion of zinc may be varied within a range of approximately four ounces (4 ozs.) above or below the quantity mentioned in the above example. In the case of the antimony, it may be varied to the extent of approximately one ounce (1 oz.) above or below the quantity mentioned in the above example.

The tin should preferably be maintained at approximately the same proportion as in the foregoing example, for instance, the tin may be maintained at approximately sixteen ounces (16 ozs.) whilst the zinc may be varied down to three (3) or up to eleven (11) ounces, and the antimony varied down to half an ounce ($\frac{1}{2}$ oz.) or up to two and a half ounces ($2\frac{1}{2}$ ozs.) within the ambit of the invention.

The tin acts as a softening agent and preferably constitutes about twice the amount of the zinc and antimony combined.

The improved alloy may be produced by melting the zinc whilst using borax, for instance as a flux and cleanser, until the zinc reaches a dull red heat, for example, at approximately 800° F. When the zinc reaches this temperature the antimony in approximately the above proportion, is added and these constituents are then mixed thoroughly together before skimming off all of the flux and other scum that has formed.

Upon completion of these operations, the aforesaid approximate amount of tin is added and the mixing and skimming operations repeated after which the metal is poured into moulds.

Experiment has shown that the scum obtained as a result of the first skimming operation should be of a light bluish colour, somewhat similar to the colour of opal. The colour of the scum, obtained as a result of the second skimming operation, should be approximately similar to that of white metal dross. The colour of the scum has been found to furnish an effective indication as to whether the proper heat has been attained during the respective stages in the production of the alloy.

The improved alloy may be applied at relatively low temperatures, for example

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between 300° and 400° F. For this purpose an oxy-acetylene welding torch may be employed or even a very hot soldering iron heated for instance, to about 400° F. After the alloy has been applied it has been ascertained that its melting point increases to the region of 600° F. (more or less) thus providing a 25% to 50% increase in the melting point of the alloy.

The presence of the antimony has been found to provide a substantial increase in the strength and hardness of the alloy.

It is to be understood that the invention is not limited to the particular proportions above referred to.

Dated the 18th day of July, 1938.
GEE & CO.,
Patent Agents,
Staple House, 51 and 52, Chancery Lane,
London, W.C.2,
Agents for the Applicant.

COMPLETE SPECIFICATION

An Improved Alloy for Fusion Welding and/or Soldering and Method of making such Alloy

I, HARRY THOMAS PAGE GEE, of 51 and 52, Chancery Lane, London, W.C.2, a British Subject, do hereby declare the nature of this invention (as communicated to me by Dorothea Surrey Lewis, of 242, Kooyong Road, Toorak, and Thomas Shead, of 105, Elgin Street, Carlton, both in the State of Victoria, Commonwealth of Australia, British Subjects), and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improved fusion welding and/or soldering alloy particularly suitable for jointing and repairing aluminium, aluminum alloys and die cast metal articles, but is also suitable for the soldering of other metals requiring a fusion welding or soldering alloy stronger than common solder, and is capable of being employed over a wide range of fusion welding and/or soldering temperatures.

The primary object of the present invention is to provide an improved alloy as above indicated which is capable of being applied as a solder at a relatively low temperature, whilst, in addition, the alloy is also capable of being employed in a fusion welding or like operation, the melting point of the alloy materially increasing after such heat treatment owing to the volatilization of the more volatile metals constituting such alloy.

Other advantages of the invention are that the improved alloy includes a constituent which imparts strength and hardness thereto and is superior in this respect in relation to known fusion welding alloys, whilst another important advantage resides in the fact that a separate flux is not required for the fusion welding of aluminium, aluminium alloys and die cast metal articles, with the improved alloy.

Another object of the invention is to provide a simple and inexpensive method of manufacturing the improved alloy.

According to the present invention, zinc is melted with a flux and cleansing agent, then antimony is mixed with the zinc whereafter tin is incorporated with the antimony and zinc mixture and the metal is poured into suitable moulds.

The improved alloy may be prepared by melting the zinc whilst using borax, for instance, as the flux and cleanser, until the zinc reaches a dull red heat, for example, at approximately 800° F. When the zinc reaches this temperature, the antimony is added and these constituents are then mixed thoroughly together before skimming off all of the flux and other scum that has formed.

Upon completion of these operations, the tin is added and the mixing and skimming operations repeated after which the metal is poured into moulds.

Experiment has shown that the scum obtained as a result of the first skimming operation should be of a light bluish colour, somewhat similar to the colour of opal. The colour of the scum obtained as a result of the second skimming operation, should be approximately similar to that of white metal dross. The colour of the scum has been found to furnish an effective indication as to whether the proper heat has been obtained during the respective stages in the production of the alloy.

Electrolytic zinc is preferably employed in the preparation of the improved alloy and according to one practical example, the alloy includes the above constituents in the following approximate proportions by weight:—

tin	-	32 parts
zinc	-	14 parts
antimony	-	3 parts

The alloy also preferably includes a proportion of bismuth as an additional constituent which may be premixed with the tin and such mixture added to the molten zinc and antimony described above or the bismuth may be added separately, follow-

ing the addition of the tin to the molten zinc and antimony mixture.

The range of proportions of the above constituents may be varied within certain limits if desired. For instance, while maintaining the tin at the preferred portion of 32 parts, the proportion by weight of zinc may be varied within a range of approximately six (6) parts to twenty-two (22) parts, whilst in the case of the antimony, it may be varied to the extent of approximately one (1) part to five (5) parts.

The tin acts as a softening agent and predominates in the alloy, whilst the proportion by weight of zinc is substantially in excess of that of the antimony. Preferably the tin constitutes, in proportion by weight, about twice the amount of the zinc and antimony combined.

Preferably, a quantity of bismuth is combined with the tin, zinc and antimony in accordance with the invention, and in such case the approximate relative proportions by weight of the constituents in the alloy may be as follows:—

tin - - -	64 parts
zinc - -	12 parts to 44 parts
antimony -	2 parts to 10 parts
bismuth -	1 part

More specifically, an alloy in accordance with the invention and comprising in combination tin, zinc, antimony and bismuth, may be in the following relative proportions by weight:—

tin - - -	64 parts
zinc - -	28 parts
antimony -	6 parts
bismuth -	1 part

It has been found that the bismuth decreases the melting point of the alloy and renders it more smoothly flowing and should be preferably added, either separately or in admixture with the tin, during the mixing process. After the tin and bismuth have been added, it is necessary, or very desirable, to keep the alloy at as low a temperature as possible in order to prevent volatilization of the more volatile constituents, particularly the tin content.

The improved alloy may be employed as a jointing or repairing medium for metal articles other than aluminium, aluminium alloys and die cast metal, at relatively low temperatures, for example, between 300° F. and 400° F., in which case it is employed with any suitable soldering flux and functions somewhat as a soldering alloy. For this purpose, a flame torch or even a very hot soldering iron heated for instance to about 400° F. may be applied to the alloy in stick form to effect a soldering operation.

After the alloy has been applied, it has been ascertained that volatilization of a proportion of the more volatile constituents takes place and as a result, the melting point of the residual metal of the alloy on the joint or repair has increased to the region of 600° F. (more or less), thus providing a 25% to 50% increase in the melting point of the alloy. In this regard, it has been found that the presence of the antimony in the alloy imparts strength and hardness thereto.

The application of the improved alloy to the jointing and/or repairing of aluminium, aluminium alloys and die cast metal articles is in the form of a fusion welding process, as distinct from the soldering process previously described, the alloy being applied without the use of a separate flux and by fusion or semi-fusion of the articles being treated, at say, 600° F. to 1000° F., by applying the heating flame to the parent metal and not to the stick of alloy. It has been determined that the correct time to apply the improved alloy in such fusion welding of these articles is when the parent metal or article is well blistered or is in a state of semi-fusion. The cold stick of alloy is then applied to the article and breaks through the blistered skin of the parent material, melting at a lower temperature than the latter and alloying or amalgamating therewith.

It will be appreciated that as such fusion welding process employs a relatively high degree of heat, the heat causes volatilization of a substantial proportion of the tin and bismuth content of the alloy, whereby the harder metals, zinc and antimony, remain deposited upon the welded joint or repair.

The improved alloy will readily fuse or weld with die cast metal or aluminium or aluminium alloy castings, and in the case of castings such as crank cases or gear boxes and the like, which are usually about one-quarter of an inch thick, the parent metal of the casting is fused to about half its thickness, that is, about one-eighth of an inch, whereupon the cold stick of alloy is applied to such fused article. This fusing is termed "blistering".

Aluminium at blistering or fusion heat has a skin over the fused part and it is necessary to break this skin before the alloy will amalgamate with the casting. The moment this fusion skin is broken, the alloy is applied and combined with the parent metal.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. The method of preparing an im-

proved alloy for use in fusion welding aluminium, aluminium alloys and die cast metals without the use of a separate flux and also for soldering other metals with a suitable flux, which comprises melting zinc with a flux and cleansing agent then mixing antimony with the zinc and subsequently incorporating tin with the antimony and zinc mixture, after which the metal is poured into suitable moulds.

2. The method according to Claim 1, wherein the zinc is heated with the flux and cleansing agent until it reaches a dull red heat, for example, 800° F., and after the antimony has been added and mixed with the zinc, the flux and other scum is skimmed off the surface of the mixture prior to the incorporation of the tin therewith.

3. The method according to Claim 2, wherein the skimming operation is repeated after the tin has been incorporated with the zinc and antimony mixture.

4. The method according to Claim 3, wherein the first skimming operation is effected when the scum is of a light bluish colour, somewhat similar to the colour of opal, and the second skimming operation is effected when the scum is similar in colour to that of white metal dross, substantially as described.

5. The method according to any one of Claims 1 to 4 wherein the tin, zinc and antimony are combined in the following relative proportions by weight:

tin	- -	32 parts.
zinc	- -	6 parts to 22 parts.
antimony	-	1 part to 5 parts.

6. The method according to any one of the preceding Claims wherein bismuth is added either separately, or in admixture with the tin, to the heated mixture of zinc and antimony.

7. The method of preparing fusion welding and/or soldering alloys substantially as herein described.

8. An improved alloy for fusion welding aluminium, aluminium alloys, and die cast metals without the use of a separate flux and also for soldering other metals with a suitable flux, when prepared by the method claimed in any one or more of the preceding claims.

9. An improved fusion welding and/or soldering alloy according to Claim 8, wherein the tin, zinc and antimony are combined in the following relative proportions by weight:

tin	- - -	32 parts
zinc	- -	14 parts
antimony	-	3 parts

10. A fusion welding and/or soldering alloy according to Claim 8 comprising in combination tin, zinc, antimony and bismuth in the following relative proportions by weight:

tin	- - -	64 parts
zinc	- -	12 parts to 44 parts
antimony	-	2 parts to 10 parts
bismuth	-	1 part

11. A fusion welding and/or soldering alloy according to Claim 8 comprising in combination tin, zinc, antimony and bismuth in the following proportions by weight:

tin	- - -	64 parts
zinc	- -	28 parts
antimony	-	6 parts
bismuth	- - -	1 part

Dated the 28th day of October, 1938.

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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1940.